Phytochemical Analysis of Certain Species of *Cyperus* L. and *Kyllinga*rottb. (Cyperaceae) in Nanded District of Maharashtra State

Ph.D Synopsis/Work Plan

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INDEX

Sr.No	Contents	Page number
1	Introduction	03
2	Review of literature	05
3	Objectives of research	09
4	Methodology	10
5	Importance of study	11
6	Proposed work plan	14
7	Literature cited	15

Introduction:

The family Cyperaceae is of the largest and most intricate groups of angiosperms. The members of the family are commonly called as sedges. It is represented by about 80-104 genera and over 5000 species distributed throughout the world. In India it has 28 genera and about 500 species. In peninsular India alone it is represented by 16 genera and about 400 taxa (320) species. It is the second largest family among monocotyledons and stand next to the grass family.

Critical study of sedges has been neglected by most of the investigators due to minute and greatly reduced floral structures, least economic importance, and intricacy due to extreme variations in vegetative as well as the reproductive parts. Thus the studies in Cyperaceae did not progress well as compared to those in grasses. It may be remarked here that the family remained taxonomically neglected throughout the world and more so in India (Khan, 2015).

The sedges have very simple plant body and thus have few characters in totality. The flower is microscopic unglamorous with reduced sepels and petals. The principal difference from its allied group is the extreme reduction of perianth which characteristically consists of hypogynous scales, bristles or hair or absent. The leaf sheath corresponding to petiole are closed, so that each one completely encircling the stem. In grass family the sheath is open to one side. Both annual & perennial habits are found in Cyperaceae often with adventitious root system. The underground parts in perennial show remarkable variability. The floral structures of monocotyledonous type that is the perianth (if present) and the sex organs are mostly timorous and the fruit is often called nut or achene. Both the microscopic and macroscopic morphological features are highly variable in Cyperaceae. The sedges are distributed in every farming (except epiphyles).

They form major component of wet land flora (with very few exceptions). Many species are indeed more or less grass like but often with a characteristic yellowish or brownish tinge or often partly or wholly reddish or purplish colored but few species have white color that is why Cyperceous plants are easily recognizable among the grasses and other flora.

As regards to detailed literature base morphology of Cyperaceae, classification, pollen morphology, pollination, karyology, vegetative anatomy, economic importance comparatively will be elaborated in the main text of thesis.

Other important aspects of sedges: The Indian sub continent comprises 1, 28,000 sq km of water surface of which about 77,000 sq km occurs in India. Approximately 470 species of flowering plants have been recorded from aquatic and semi aquatic habitats of Indian sub continents. Members of Cyperacea form the major component of the wetland flora. The wetland biodiversity greatly emphasized by the recent workers of India. But there is hardly any account which would be said to have touched utilitarian and ethno botanical aspects of Indian sedges. Recently the most important and beneficial properties have been properly assessed in China, Japan, certain European countries & US (Under United Nations lake management programme 1990, Japan) The aquatic macrophytes including sedges have been shown to play significant role in purification of surrounding water by way of oxidation, bioaccumulation, bioremediation of certain compound dissolved in water, removal of metal like Pb, Cu, Cd etc .Thus controlling eutrophication process etc by way of absorption & adsorption.

Medicinal sedges:

In the recent checklist (Inglis, 1994) well over 300 species are recognized for a variety of uses in many parts of the world. The medicinal and poisonous sedges of India belong to 3 genera out of 11 genera in the world (Caius 1982). 16 species belongs to 5 genera (viz C*yperus, Kyllinga, Fimbristylis, Scispus, Remirea*). Represent as medicinal and poisonous sedges alone in south India (Khan, 2015). With the exception of very few species ethno botanical studies have almost totally neglected cyperaceous plants. Narrow and broad specific delimitation and nomenclatural changes of medicinal plants are again new challenges which need to be resolved in future studies with the help of disciplines other than morphology.

Review of literature:

Jagdamba Singh and Shiv Kumar**,** (2010) observed the phytochemical investigation. These Phytochemical investigation of *Cyperus scariosus* leads to the isolation and identification of a compound2,3-diacetoxy-19-hydroxy-urs-12-ene-24-O-β-D-xylopyranoside 1 based on chemical and spectroscopic studies. *Cyperus scariosus* (Cyperacae) commonly known as Nagarmotha. The plant is generally distributed in damp places in Bengal, Sundarbans, Utter Pradesh and eastern and southern parts of India. It is also grown in Australia. This plant has been reported to have many medicinal properties.

Azrianingsih Rodiyati, (2003) studied annual growth and phenology of of *Kyllinga brevifolia* .The study shows biomass and inflorescence number of *Kyllinga brevifolia* were surveyed in Hiroshima Prefecture, Japan and in Malang, Indonesia to gain understanding of its survivorship in temperate and tropical regions. Monthly observations were conducted by using 1 m2 plots of six study sites in Hiroshima from April 2000 to April 2001 while observations in Malang were carried out in ten study sites four times a year from March 2000 to March 2001. Considering to developmental stages in the temperate zone, the growing period of *K. brevifolia* started in the early of April as the beginning of bud sprouting and vegetative development. The generative organ started to appear in the end of May and the first matured seeds occurred in the last week of June. The growing period of *K. brevifolia* underwent until December 2000 with a peak in August. The inflorescences appeared from May to December where its maximum number was in October. Average daily temperature was significant correlated with the biomass pattern. On the other hand, in the tropical region this plant grew and flowered throughout the year with peaks of biomass and inflorescence number were in the end of the rainy season (March 2000/2001). The inflorescence number was minimum in the dry season (July 2000) while the lowest biomass occurred in the early rainy season (November 2000). Furthermore, the pattern of average daily precipitation appeared to be most similar with the flowering pattern. These diverse patterns of productivity and flowering of *K. brevifolia* may explain a great adaptation of this weed to different climate across the regions.

Bhattasri Sree Charan, (2011) evaluated hepatoprotective effects Of *Kyllinga brevifolia* on Carbon Tetrachloride induced liver damage in rats. To investigate the hepatoprotective activity and acute oral toxicity of methanolic extract of whole plantof *Kyllinga brevifolia* (MEKB) in male Wistar albino rats by using CCl4 induced hepatoptoxicity. The MEKB at doses of 200 and 400mg/kg, p.o and the standard drug Silymarin (100mg/kg, p.o) were administered three times at 12h intervals and then CCl4 (1ml/kg) was administered to all the groups except normal control for 2 days. The hepatoprotective activity was assessed by using various biochemical parameters like SGOT, SGPT, ALP, γ-GT, TP and total bilirubin along with histopathological studies were observed after 36h of CCl4 treatment. The MEKB at the doses of 200 and 400mg/kg inhibited CCl4 induced liver toxicity in Wistar albino rats as assessed by the biochemical changes and histopathological studies. The methanolic extract of whole plantof *Kyllinga brevifolia* afforded significant protection against CCl4 inducd hepatocellular injury.

Elmore et. al., (1999) explained about sedge weed of turf and ornamentals Green kyllinga (*Kyllinga brevifolia)* is a weedy sedge that is becoming a major problem in turf and ornamental plantings in California. The genus, *Kyllinga,* consists of about 40 species, which are distributed worldwide in subtropical and warm temperature regions. Green kyllinga has been reported as a weedy problem from Florida across the southeastern U.S. into Arizona, California and Hawaii. In California, it has been reported from San Diego to the Sacramento Valley. Green kyllinga is thought to have originated in Asia and was reported as a weed in California more than 50 years ago. But, it has only been in the last few years that green kyllinga has developed into a major problem for turf and ornamental managers. It is often confused with yellow or purple nutsedge due to its similarity in size and growth pattern. However, the flower and absence of underground tubers make it easily distinguishable from these species.

Beatriz et. al., (2016) studied Volatile chemical composition and bioactivities from Colombian *Kyllinga pumila* Michx (Cyperaceae) essential oi **.** The essential oil from the fresh leaves of *Kyllinga pumila* (Michx) was obtained by hydrodistillation and characterized by gas chromatography-mass spectrometry (GC-MS). Twenty-eight volatile compounds were identified, major constituents of

the oil were Methyl E,E-10,11-epoxyfarnesoate (43.8%), β-elemene (12.5%), Z-caryophyllene (11.3%), germacrene D (7.1%) and E-caryophyllene (5.6%). Repellent and fumigant activities of the oil against *Tribolium castaneum* Herbst (Coleoptera: Tenebrionidae), were done using the area preference method. Additionally, we studied their antioxidant and phytotoxic effects. Essential oils exhibited a dose-dependent repellent activity, with values 90% at the applied concentration (0.01%), for both two and four hour's exposure. Essential oil from *K. pumila* showed 92% mortality at 500 µL L-1 air against *T. castaneum* on 24 hours of exposure. The value LC50 was 153.4 µL L-1.With moderate selective phytotoxic effects on *L. perenne* root growth (±70% inhibition). *Kyllinga pumila* shows high antioxidant potential (91.5%), an effect that is comparable with ascorbic acid (92.9%) used as a standard. The results indicated that *K. pumila* essential oil could be a promising alternative to new natural antioxidants, repellents, and biocides.

Prajwal Paudel et. al, (2012) studied leaf essential oil composition of *Kyllinga brevifolia* Rottb. from Nepal. The essential oil from the leaf of *Kyllinga brevifolia* Rottb., collected from Biratnagar, Nepal, was obtained by hydrodistillation and analyzed by GC-MS. A total of 22 compounds were identified in the oil accounting for 96.1 % of the oil composition. The majority of the essential oil was identified to be α- cadinol (40.3 %), τ-muurolol (19.5 %), and germacrene D-4-ol (12.5 %). The oil also contained smaller amounts of δ-cadinene (2.9 %), and germacrene D (4.0 %). Reports on the essential oil composition of *K. brevifolia* from Nepal were compared with a sample from Brazil, which showed that 13-*epi*-manoyl oxide (26.1 %) and manoyl oxide derivatives constituted the majority of composition with α-cadinol comprising only 0.4 %. However germacrene D was found in similar percentages between Nepal and Brazil samples (4.0 % and 4.2 %, respectively).

Srivastava et. al., (2014) give review on Chemical Constituents and Biological Activities of Promising Aromatic Plant Nagarmotha (*Cyperus scariosus* R.Br. Nagarmotha is pestiferous perennial, delicate slender sedge found wildly in various parts of the country, especially in damp or marshy areas and collected wildly for extraction of its essential oil using steam distillation. The rhizomes of *C. scariosus* possess pleasant aromatic odour, the essential oil is used as anti-inflammatory, anti-microbial and anti-fungal agent and it is also used as one of the ingredients in several formulations for the Ayurvedic systems of medicine. Phytochemical studies have shown that the major chemical components of this

herb are polyphenol, flavonol, glycoside, alkaloid, saponins, sesquiterpenoids and essential oil. Rhizome of the plant is used in fever, arthritis, diuretic, nervine tonic, treatment of diarrhea and dysentery, leprosy, bronchitis, amenorrhea and blood disorders. The fruits of the plant are used as carminative, diuretic tonic and have stomachic. The details of plant and its essential oil, chemical constituents and biological activities have been described in this review.

Objectives of research:

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1- The collection, identification and preservation of *Cyperus scariosus* R.Br , *Cyperus stoloniferus* Retz , *Kyllinga brevifolia* Rott b. *and Kyllinga nemovalis* (J.R & G Frost) Dandy ex Hutchinson & Dalz.
2- Study about utilization of these plants from tribal's, rural peoples and available literature.
3- Macroscopical and microscopical studies of selected plants.
4- Detection of phytochemicals from *Cyperus* and *Kyllinga* species.
5- Estimation of principal active ingredients and phytochemical studies.

Methodology:

1- Taxonomical approach

- Collection of plants from different parts of Nanded district Maharashtra state.
- Identification of study plants species with the help of macro morphology and micro morphological characters and scientific preservation of plant species.

2- Qualitative analysis

- Preparation of plant powder and extract.
- Detection of bioactive compounds or phytochemicals.

3- Quantitative analysis

- Estimation of active ingredients from *Cyperus* species.
- Estimation of active ingredients from *Kyllinga* species.

Importance of study:

There has been always contaversial opinion among the cyperologists or taxonomists about the generic and intrageneric delimitation of the two genera under study. In other words the interrelationship of *Cyperus* and *Kyllinga* has not been well understood on morphological ground. It is hope that the phytochemical investigation of the study plants will provide convensing supportive evidence for the proper interpretation of generic and intrageneric delimitations.

The genus *Kyllinga*;

Taxonomically it was raised by Rottboel in 1773 there has been inconstituent treatment of *Kyllinga*. Boeckeler, (1886) retain *Kyllinga* as a seprate genus while Clark (1884) merged it with the genus *Cyperus*. Clarke (1902) again treated *Kyllinga* as a distinct genus (khan, 2015).

The genus *Cyperus:*

It was raised by Linnaeus C. (1753). The genus is large with over 600 species in the world, well represented by 84 taxa (71 species) in India, while in Marathwada and in study region *Cyperus* (in broad sense) comprising of 33 taxa (species 30) W. Khan & Naik V.N in 1998. Some authors treat *Cyperus* in broad sense merging about 9-10 smaller genera including *Kyllinga* in it. Recent taxonomists treat *Cyperus* in narrow generic sense & all other 9-10 smaller genera considered distinct generically. The genus *Cyperus* is thus, treated variously by different taxonomists.

Phytochemistry:

The phytochemistry of Indian cyperaceae is no still studied extensively in India. Very few scattered attempts seem to have been made from the view point of ethnobotany and pharmagnocy. However very recently phytochemicalanalysis in certain species of genus *Eleocharis* has been initiated by the taxonomic school of

Nagpur University. A survey of vast phytochemical literature pertaining to Cyperacea was given by Hegnaur , (1963 to 1986). Metabolically the Cyperaceae are similar to Poaceae and some other monocot families. It needs to be mentioned that flavonoids & protoanthocyanidin metabolism also suggests affinities between Cyperacea, Juncaceae, Poaceae and Arecaceae (Harbornem Dahlgren and Clifford 1982 Ex. Goetgheur, 1998) with regards to the classification within the family Cyperaceae phenolic and quinonoid constituents seems to be of great significance. Equal importance lies in the silica bodies and apiculture wax. The phytochemicals present in *Cyperus scariosus* R.Br , *Cyperus stoloniferus* Retz , *Kyllinga brevifolia* Rott b. *and Kyllinga nemovalis* (J.R & G Frost) Dandy ex Hutchinson & Dalz.

The study region:

Nanded district of Marathwada region of Maharashtra has been proposed as the study region for the field exploration and collection of study plants of Cyperaceae. The forest regions of Kinwat, Bhokar & their plains of Dharmabaad, Degloor, Mirzapur & several other places in the vicinity of Taluka Nanded where occurs a large no. of aquatic & semi aquatic habitats. These habitats have been shown to harbor wide variety of Cyperaceae plants (Naik, 1998).Hence selected for present investigation.

The study plants - morphology:

Four species belonging two different genera of Cyperaceae have been selected for the phytochemical studies *Cyperus* L. & *Kyllinga* Rottb. are the two genera each with two species each viz, *Cyperus scariosus* R.Br, *Cyperus stoloniferus* Retz., *Kyllinga brevifolia* Rott.and *Kyllinga nemovalis* (J.R & G Frost) Dandy ex Hutchinson & Dalz. These species are distributed in different parts of Nanded district of Marathwada region of Maharashtra state.

Ethnobotanical & medicinal aspects of study plants:

On the basis of rustics and phytomedicinal literature 4 species of Cyperaceae belonging to two different genera have been selected for phytochemical analysis. However modern scientific mind does not wisdom is experimentally assessed. The active principles of the plants are the secondary metabolites some of them may represent antimicrobial agents and several other chemicals produce definite physiological action on human body. Hence the present phytochemical study aims to provide preliminary or firsthand information with regards to principle chemical constituents found in underground & aerial parts of 4study plants under specialized design of work, methodology & tool of experimental laboratory exercises.

In the proposed six species of Cyperaceae the phytochemical study has not been so far carried out in India. However, the study plants are being used in indigenous system of medicine. This needs to be correlated with present phytochemical investigation which may result into innovation of new chemical compounds.

Proposed work plan:

Sr. no.	Year	Duration	Proposed work
1	2018	Jan-Jun	Course work & simultaneously Collection, Isolation and Identification of samples.
		Jun-Dec	Detection of phytochemicals of *Cyperus* species.
2	2019	Jan-Jun	Estimation of phytochemicals of *Cyperus* species.
		Jun-Dec	Detection of phytochemicals of *Kyllinga* species
3	2020	Jan-Jun	Estimation of phytochemicals of *Kyllinga* species
		Jun-Dec	Finalization of obtained results, stastical analysis and submission of thesis.

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